

Remarks

The non-final Office Action dated August 19, 2011, indicates claims 2, 4 and 30 are allowed. The Office Action presents objections to the title and drawings, as well as the following claim rejections: claim 7 stands rejected under 35 U.S.C. § 112(1); claims 23, 25 and 28 stand rejected under 35 U.S.C. § 102(b) over Gardes (U.S. Patent No. 6,830,970); claims 24 and 26 stand rejected under 35 U.S.C. § 103(a) over the '970 reference in view of Hsuan (U.S. Patent Pub. 2001/0005046); claims 1, 3, 5-6, 8, 10, 20-23, 25, 27 and 29 stand rejected under 35 U.S.C. § 103(a) over Chudzik (U.S. Patent No. 7,030,481) in view of Gambino (U.S. Patent No. 6,025,226); and claims 1 and 31 stand rejected under 35 U.S.C. § 103(a) over the '481 and '970 references. Claim 9 stands objected to, but is indicated as being allowable if rewritten in independent form. In this discussion set forth below, Applicant traverses all rejections and further does not acquiesce to any rejection or averment in the instant Office Action unless Applicant expressly indicates otherwise.

The § 102(b) and § 103(a) Rejections Over the '970 Reference Are Improper

Applicant respectfully traverses the §§ 102(b) rejections of claims 23, 25 and 28, as well as the 103(a) rejections of claims 24 and 26, because the cited '970 reference, alone or as combined, lacks correspondence. For example, the asserted reference does not appear to teach the claimed invention "as a whole" including aspects regarding, *e.g.*, a vertical interconnect having walls lined with conductive material, and a single deposition layer of dielectric material on first and second sides of a substrate, on the conductive material lining trenches, and on the walls of the vertical interconnect. Importantly, the instant Office Action has applied a new interpretation to the term "lining" that is not only inconsistent with Appellant's specification, but also inconsistent with the very definition of the term offered in the Office Action. In addition, the Office Action has inappropriately dismissed Applicant's arguments relating to a single-layer dielectric material by arguing process steps relating to the formation thereof; in contrast to the Examiner's assertions that the process of formation is inapplicable, Applicants traversals establish that the '970 reference is incapable of corresponding as asserted. As such, the rejection fails.

More specifically, Applicant submits that the Examiner's proposed interpretation of "lining" of a trench, as being applicable to anything that happens to be "in" the trench, is impermissible because it contradicts Applicant's specification, and is further unsupported in the cited references as providing a corresponding embodiment. Moreover, the Examiner's proposed interpretation also contradicts the Office Action's indication that lining is "in contact with" a surface. Referring to Figure 2D, the Office Action has asserted that the conductive material 25 lines the trenches 21, and that dielectric material 24 is on the conductive lining material. However, as shown in Figure 2S, the conductive material 25 does not line the trenches 21. Rather, the oxide 24 lines the trench 21, and the metal 25 is formed to fill the trench as bounded by the oxide 24. The Examiner's interpretation of the conductive material 25 as lining the trenches 21 in accordance with the claimed invention is unsupported in the '970 reference.

Notwithstanding the above, Applicant has amended claim 23 in a manner that is believed to be consistent with a proper interpretation of the claims as presented, prior to amendment. Specifically, Applicant has amended claim 23 to recite that the conductive material is in physical contact with a sidewall surface of the trench, and further that the conductive material is between the single layer dielectric and the sidewalls. Support for these amendments may be found throughout the specification and figures, with example embodiments shown in and described in connection with Figure 2d and at page 11:31-12:12. Applicant believes that this amendment should assist the Examiner's understanding, in view of which the § 102(b) and § 103(a) rejections of claims 23-26 and 28 are inapplicable.

The § 103(a) Rejections Over the '481 Reference Lack Correspondence

Applicant respectfully traverses the § 103(a) rejections over the '481 reference, alone or in combination with the '226 or '970 references because the '481 reference does not correspond to various aspects of the claimed invention as asserted. For example, the Office Action has failed to establish that the '481 reference discloses a dielectric material that insulates an interconnect from a substrate in which a vertical trench capacitor is formed, as the cited dielectric material appears to instead separate two capacitor plates. As another example, the Office Action has not established correspondence to aspects of

the claimed invention directed to a device having both vertical trench capacitors and vias with a common dielectric layer therein. In particular, the Office Action has failed to provide an enabled embodiment in which the '481 reference would use such a layer, with motivation for doing so. As such, the rejections fail.

More specifically, the cited interconnect 410' of the '481 reference is one plate of a capacitor that includes the cited dielectric material 420' and another capacitor plate 4080' (*see, e.g.*, Figure 4b and 6:13-25). This capacitor plate 4080' includes a highly-doped semiconductor material that is transformed into a conductive material in order to function as a capacitor plate. In this context, the cited dielectric material 420' is a capacitor dielectric that separates the respective plates and via which a capacitive coupling is facilitated. Accordingly, the Office Action has failed to explain how this capacitor dielectric 420' could or would function to provide any insulation of the capacitor plate 410' from the substrate 200 in which the cited capacitor 3010 is formed.

Furthermore, the Examiner's assertion that the capacitor dielectric material 420' and the dielectric material 3020 of the '481 reference could be replaced by a single layer is unsupported in the references, and is devoid of any explanation as to how such an arrangement would be formed and/or function with the '481 reference. For example, the Office Action has provided no explanation as to how the respective dielectric materials could be formed in a single step, as the '481 reference requires a high-doping process prior to formation of the dielectric 410', which the Office Action has not addressed with respect to the corresponding formation of the vertical trench capacitor 3010. The Examiner's attempt to address Applicant's traversals regarding this lack of explanation at page 18 of the Office Action merely asserts (again) that the secondary '226 reference "shows a single dielectric layer is formed in the trenches." This assertion fails to provide any further explanation as to how such a single layer would actually be implemented with the '481 reference. Mere citation to disparate components without any explanation as to how such components would be combined is insufficient to establish teaching or suggestion under § 103.

Applicant further traverses the § 103(a) rejection of claims 1 and 31 over the '481 and '970 references for reasons including those discussed above in connection with the rejections of claims 23-26, as the secondary '970 reference fails to correspond as asserted.

For example, the '970 reference does not disclose a vertical trench capacitor having walls lined with conductive material. Moreover, as the asserted oxide 24 does not form between first and second conductive trenches of vertical trench capacitors, combining the oxide 24 with the '481 reference would appear to require a single-conductor in the resulting trench, thus failing to correspond to the claimed invention as asserted. Further, the Office Action does not explain how such correspondence could be present as the rejection is not accompanied by any interpretation or further explanation in this regard. As such, the rejection fails.

The § 103(a) Rejections Over the '481 Reference Lack Motivation

Applicant also traverses the § 103(a) rejections over the '481 reference, alone or in combination with the '226 or '970 references because the Office Action failed to provide proper motivation for combining the references, and in many instances, failed to provide any explanation as to how the references would be combined (and thus failed to provide any motivation for the resulting unexplained combination). For example, as discussed above, the Examiner failed to explain how the cited dielectric layer of the '226 reference would be used to replace the cited dielectric layers 3020 and 420', or how the device shown in the '481 reference could be formed (with highly-doped capacitor plate 4080') with such a combination.

In addition, the alleged motivation relies upon an assertion that one would be motivated to modify the '481 reference because "a single deposition layer eliminates the need for an additional step to pattern the dielectric layer." However, this statement appears to contradict the cited portions of the '481 reference itself, which would appear to explicitly require such a patterning step in order to form conductive interconnects. For example, referring to cited Figure 3b, the '481 reference forms various connections including contact 3090 that would appear to necessarily interrupt any single layer formed as asserted, in both vertical trench capacitors and in a vertical interconnect. This contradiction is in violation of M.P.E.P. § 2143.01. *In re Gordon*, 733 F.2d 900 (Fed. Cir. 1984) (A §103 rejection cannot be maintained when the asserted modification undermines purpose of the main reference).

It would further appear that requiring the dielectric material in the '481 reference to be a single layer would actually introduce additional steps to the '481 reference, in requiring such etching. The Office Action has failed to provide any explanation as to how this asserted benefit/motivation would be or could be implemented with the cited references.

Accordingly, it would not have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teaching of '481 reference with the teaching of any reference to implement a single deposition layer of dielectric material as asserted. As such, the § 103(a) rejections over the '481 reference are improper and should be removed.

The Drawing Objections Are Improper

Regarding the Objection to the drawings with respect to the subject matter in claim 7, the Office Action has used the wrong standard in making the rejection, and failed to establish that the drawings fail to comply with 37 CFR § 1.83(a). More specifically, the Examiner's indication that the "drawings must show every feature of the invention specified in the claims" addresses only a limited portion of the appropriate rule. Referring to 35 USC § 113 and M.P.E.P. § 601.01(f), drawings shall be furnished "where necessary for the understanding of the subject matter sought to be patented." As the authority for the U.S.P.T.O. to create rules such as 37 C.F.R. § 1.83(a) is derived from 35 USC § 113, 37 C.F.R. § 1.83(a) must be interpreted in light of this law to ensure that the U.S.P.T.O. does not exceed the statutory authority granted by the U.S. Congress. M.P.E.P. § 608.02(e) further clarifies the application of 37 C.F.R. § 1.83(a): "[t]he drawings are objected to under 37 CFR 1.83(a) because they fail to show [1] as described in the specification. Any structural detail *that is essential for a proper understanding of the disclosed invention* should be shown in the drawing" (*emphasis added*).

As applicable here, the Examiner has failed to establish, or even assert, that one of skill in the art would be incapable of understanding the claimed invention, and that a drawing would be essential for such an understanding. Instead, the Examiner appears to be requiring explicit correspondence between each claim limitation and the details in every claim. This approach contradicts 37 CFR § 1.83(a), and is contrary to U.S.P.T.O.

practice, U.S. law and the M.P.E.P. Accordingly, the Examiner has neither used the appropriate language for objecting to the drawings, nor explained how one of skill in the art would be incapable of understanding aspects of the claimed invention directed to a dielectric material that extends onto a surface of a second side of a substrate, at a location that is between the second side and an integrated circuit. The Examiner has thus failed to provide an adequate explanation regarding why illustration of such a feature is essential for a proper understanding of the disclosed invention by one of skill in the art. Accordingly, the objection to the drawing is improper and Applicant requests that it be removed.

The § 112(1) Rejection of Claim 7 is Improper

Regarding the § 112(1) of claim 7, Applicant believes the rejection is improper in view of the above discussion regarding the impropriety of the objection to the drawings as based upon the same subject matter, and further because the Office Action has not met the initial burden of establishing that one of ordinary skill in the art would be unable to understand the disclosure in light of the specification and state of the prior art, or to convey that the Applicant has possession of the claimed invention. “The written description requirement does not require the applicant ‘to describe exactly the subject matter claimed, [instead] the description must clearly allow persons of ordinary skill in the art to recognize that [he or she] invented what is claimed.’” *Union Oil Co. of California v. Atlantic Richfield Co.*, 208 F.3d 989 (Fed. Cir. 2000), cert. denied, 69 U.S.L.W. 3165 (Feb. 20, 2001) (No. 00-249) (quoting *In re Gosteli*, 872 F.2d 1008, 1012, 10 U.S.P.Q.2d 1614, 1618 (Fed. Cir. 1989) (citations omitted)).

As applicable here and consistent with the above discussion regarding the drawings, Applicant submits that one skilled in the art would be able to understand the claimed invention directed to a dielectric material that extends onto a surface of a second side of a substrate, at a location that is between the second side and an integrated circuit, in view of the plain language of the claims. Applicant further believes that the claim limitations to which the Examiner refers are evident from various aspects of Applicant’s disclosure, including the description provided at page 2:30-35 and discussing the formation of a dielectric “with steps carried out not only on the first side of the substrate,

but also on the second side,” as well as at page 5:1-15 describing the formation of an integrated circuit on the second side. The Examiner’s indication that the integrated circuit 50 in Figure 4e “appears to be surrounded by the dielectric material” would not appear to contradict aspects of claim 7 directed to a dielectric material between the integrated circuit and a second side of a substrate. Accordingly, Applicant requests that the §112(1) rejection be withdrawn.

Amendments

Applicant has amended the Title in accordance with the Examiner’s suggestion, and thus believes that the Office Action’s indication of descriptiveness is no longer applicable.

Applicant has amended claim 3 to recite that the dielectric material of the vertical interconnect is in direct contact with the semiconductor substrate material in which the vertical trench capacitor is formed. Applicant has also amended claim 28 and believes the claim to be allowable because the cited combination of references do not disclose, teach or suggest aspects directed to a vertical interconnect as claimed, with a conductive material extending uninterrupted between sidewall dielectric material and filling the interconnect. Applicant believes these amendments to be unnecessary for patentability over the cited references, and that the claims are allowable over the cited references for reasons as stated above. Support for these amendments may be found throughout the specification and figures, with example embodiments shown in and described in connection with Figure 2d and at page 11:31-12:12.

In view of the above, Applicant believes that each of the rejections has been overcome and the application is in condition for allowance. Should there be any remaining issues that could be readily addressed over the telephone, the Examiner is asked to contact the agent overseeing the application file, Juergen Krause-Polstorff, of NXP Corporation at (408) 518-5537 (or the undersigned).

Please direct all correspondence to:

Intellectual Property & Licensing
NXP Semiconductors
411 East Plumeria Drive
San Jose, CA 95134

CUSTOMER NO. 65913

By: 

Robert J. Crawford
Reg. No.: 32,122
Eric J. Curtin
Reg. No. 47,511
651-686-6633
(NXPS.351PA)